Dobson, Shylah

From: Harrison, Ricardo
Sent: Monday, February 24, 2003 10:18 AM
To: Saydah, Jayne; Dobson, Shylah
Subject: FW: regarding Your Ref.2658-0203P

-----Original Message-----
From: iptl@hitel.net [mailto:iptl@hitel.net]
Sent: Monday, February 24, 2003 4:25 AM
To: mailroom@bskb.com
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Subject: regarding Your Ref.2658-0203P

TO: BIRCH, STEWART, KOLASCH & BIRCH, LLP
FROM: Y.H.KIM INTERNATIONAL PATENT & TRADEMARK OFFICE

Dear Sirs:

Please find the attached the Verified English language translation and Statutory Declaration to be filed for Verified English language translation of Korean patent application number P1999-34361.

Thank you for your assistance in advance.

Very truly yours,

Y.H.KIM INTERNATIONAL PATENT & LAW OFFICE

STATUTORY DECLARATION

I, Jung Hyun SEO, a citizen of the Republic of Korea and a staff member of Y.H.KIM INTERNATIONAL PATENT & LAW OFFICE specializing in "BACK LIGHT UNIT IN LIQUID CRYSTAL DISPLAY", do hereby declare that:

1) I am conversant with the English and Korean languages and a competent translator thereof;

2) To the best of my knowledge and belief, the following is a true and correct translation of the Priority Document (No. 1999-34361) in the Korean language already filed with Korean Industrial Property Office on August 19, 1999.

Signed this 24th day of February, 2003

Jung Hyun SEO

PATENT APPLICATION

DOCUMENT NAME: PATENT APPLICATION

RIGHT CLASS: Patent

TO: COMMISSIONER

FILED DATE: August 19, 1999

TITLE OF THE INVENTION: Back Light Unit In Liquid Crystal Display

APPLICANT(S)

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The present application is filed pursuant to Article 42 of the Korea Patent Act.

Patent Attorney: Young-Ho KIM

SPECIFICATION

[Title of the invention]

BACK LIGHT UNIT IN LIQUID CRYSTAL DISPLAY

[Brief description of the drawings]

Fig. 1 is a section view showing the configuration of a conventional back light unit;

Fig. 2 is a section view showing the configuration of another conventional back light unit;

Fig. 3 is a section view showing the configuration of a back light unit according to an embodiment of the present invention;

Figs. 4A and 4B are views for explaining the relationship of a space of the cone pattern to a position of the light-guide plate in the back light unit of Fig. 3;

Fig. 5 is a view for explaining a space of the cone pattern at a specific area of the light-guide plate in the back light unit of Fig. 3;

Fig. 6 is a detailed perspective view of the light-guide plate in Fig. 3;

Fig. 7 is a characteristic graph illustrating a distribution of light beams outputted from the light-guide plate in Fig. 3; and

Figs. 8A and 8B are section views showing another examples of the prism sheet in Fig. 3.

<Description of the marks for principal portions in the drawings>

2,32 : reflective plate	4,34 : light-guide plate
6,12,38 : diffusion sheet	8,10,14,36,40,42 : prism sheet
20,50 : light input	22,44 : lamp
24,46 : lamp housing	60 : rubber packing

[Detailed description of the invention]

[object of the invention]

[Technical field including the invention and prior art therein]

This invention relates to a liquid crystal display, and more particularly to a back light unit in the liquid crystal display that is adapted to minimize a reflection of the pattern and wall surface of a light-guide plate and bright lines of a light input.

Generally, a liquid crystal display (LCD) controls a transmitted amount of light beams supplied from a back light unit by means of a liquid crystal panel consisting of a number of liquid crystal cells arranged in a matrix type and a number of control switches for switching video signals to be applied to the liquid crystal cells, thereby displaying a desired picture on a screen. The back light unit will be described with reference to Fig. 1 and Fig. 2 below.

Referring to Fig. 1, the conventional back light unit includes a light-guide plate 4 for guiding light beams passing through a light input 20, a reflective plate 2 arranged under the light-guide plate 4 to reflect light beams progressing toward the lower surface and the side surface of the light-guide plate 4 into the upper surface thereof, a first diffusion sheet 6 for diffusing light beams passing through the light-guide plate 4, first and second prism sheets 8 and 10 for controlling a progress direction of light beams passing through the first diffusion sheet 6, and a second diffusion sheet 12 for diffusing light beams passing through the prism sheets 8 and 10. The light input 20 consists of a lamp 22 for generating light beams, and a lamp housing 24 for packaging the lamp 22 and reflecting the light beams from

the lamp 22 into the light-guide plate 4. The lower surface of the light-guide plate 4 is provided with a printed pattern. This printed pattern does not meet a total reflection condition of the light beams passing through the light input 20, thereby allowing the light beams to be uniformly progressed into the upper surface of the light-guide plate 4. At this time, the light beams progressing toward the lower surface and the side surface of the light-guide plate 4 are reflected by the reflective plate 2 to be progressed into the upper surface thereof. The light beams passing through the light-guide plate 4 are diffused into the entire area by means of the first diffusion sheet 6. The light beams incident to a liquid crystal panel (not shown) has a large light efficiency at right angles. To this end, it is desirable that two forward prism sheets are disposed to make a progress angle of the light beams outputted from the light-guide plate 4 perpendicular to the liquid crystal panel. As shown in Fig. 1, the light beams passing through the first and second prism sheets 8 and 10 are incident to the liquid crystal panel via the second diffusion sheet 12. The conventional back light unit having the configuration as described above can not obtain a desired visual angle profile until two prism sheets are included. Accordingly, it has problems in that a light loss does not only increase, but also a manufacturing cost rises. A structure having suggested for the purpose of solving the above-mentioned problems is shown in Fig. 2.

Referring now to Fig. 2, the conventional back light unit includes a light-guide plate 4' for guiding light beams passing through a light input 20, a reflective plate 2 arranged under the light-guide plate 4' to reflect light

beams progressing toward the lower surface and the side surface of the light-guide plate 4' into the upper surface thereof, a prism sheet 14 for controlling a progress direction of the light beams passing through the light-guide plate 4', and a diffusion sheet 12 for diffusing light beams passing through the prism sheet 14. Since the light input 20 and the reflective 2 have the same function and operation as those in Fig. 1, an explanation as to them will be omitted. The lower surface of the light-guide plate 4' is provided with a prism-shaped pattern. This prism-shaped pattern does not meet a total reflection condition of the light beams passing through the light input 20, thereby allowing the light beams to be uniformly progressed into the upper surface of the light-guide plate 4'. In this case, it is desirable that, since an angle of the light beams outputted the light-guide plate 4 is more than about 65°, vertical angles of the prism sheet 14 should maintain 63° to 70°. Thus, the light beams passing through the prism sheet 14 make right angles with respect to the liquid crystal panel. The light beams passing through the prism sheet 14 are diffused into the entire area by means of the diffusion sheet 12. The conventional back light unit having the configuration as described above has problems in that, since the backward prism sheet 14 is included, the wall surface of the light-guide plate 4 not only get reflected, but also bright lines of the light input 20 are seen.

Therefore, it is necessary to provide a new scheme capable of reducing the manufacturing cost as well as minimizing the wall surface reflection and the bright lines of the light input.

[Technical subject matter to be solved by the invention]

Accordingly, it is an object of the present invention to provide a back light unit in a liquid crystal display that is adapted to minimize a reflection of the pattern and wall surface of a light-guide plate as well as bright lines of a light input.

[Configuration and operation of the invention]

In order to achieve these and other objects of the invention, a back light unit in a liquid crystal display according to an aspect of the present invention includes a light-guide plate provided with a cone pattern to uniformly guide a light beam passing through a light input; light-path converting means for controlling a progress direction of the light beam in such a manner that the light beam outputted from the light-guide plate is progressed in a direction perpendicular to a liquid crystal panel; and a diffusion sheet for diffusing the light beam passing through the light-path converting means into the liquid crystal panel.

These and other objects of the invention will be apparent from the following detailed description of the embodiments of the present invention with reference to the accompanying drawings, in which:

Hereafter, the preferred embodiment of the present invention will be described by referring to the accompanying Figs. 3 to 8.

Referring to Fig. 3, there is shown a back light unit according to an embodiment of the present invention. The back light unit includes a light-guide plate 34 provided with a cone pattern 34a to uniformly light beams passing through a light input 50, a reflective plate 32 arranged under the light-guide plate 34 to reflect light beams

progressing toward the lower surface and the side surface of the light-guide plate 34, a light-path converter 36 for controlling a progress direction of the light beams in such a manner to the light beams outputted from the light-guide plate 34 are progressed in a direction perpendicular to a liquid crystal panel (not shown), and a diffusion sheet 38 for diffusing the light beams passing through the light-path converter 36. The upper surface or the lower surface of the light-guide plate 34 is provided with the cone pattern 34a so as to uniformly distribute the light beams passing through the light input 50.

The relationship of the cone pattern 34a to a distribution of light beams will be described with reference to Figs. 4A and 4B. It is desirable that, as it becomes more distant from the light input 50, a space of the cone pattern 34a should be more densely formed at the upper surface or the lower surface of the light-guide plate 34 as shown in Fig. 4B. Thus, the cone pattern 34a formed at the upper surface or the lower surface has a distribution as shown in Fig. 4A. In other words, it is desirable to control the space of the cone pattern 34a in such a manner to correspond to a distribution of the light beams.

In the structure of the plane light-guide plate 34, parts which are partially dark (i.e., oblique areas) as shown in Fig. 5 are generated. This is because a portion of the lamp 44 is screened by a rubber packing 60 for fixing the lamp 44 and the length of the lamp 44 becomes smaller than that of the light-guide plate opposed thereto. It is desirable that, in order to solve this problem, a space of the cone pattern 34a should be densely formed to progress more light amounts at the dark parts.

The cone pattern 34a as shown in Fig. 6 has a diameter of 100 to 500μm and a height of 50 to 900μm. The height of

the cone pattern 34a is determined depending on a vertical angle θ', which has a range of 30° to 120° . The output angle θ of a light beam outputted from the light-guide plate 34 can be raised into the maximum angle of 35° by the combination of the light-guide plate 34 provided with the cone pattern 34a, the light input 50 and the reflective plate 32. Fig. 7 illustrates a distribution graph of an output angle θ of a light beam outputted from the light-guide plate 34 when a vertical angle θ' of the cone pattern 34a is 30° and a diameter thereof is 500μm. It can be seen from Fig. 7 that a light beam outputted from the light-guide plate 34 has a maximum value when an output angle θ is 35° . The output angle θ from the light-guide plate 34 can be adjusted in accordance with the magnitude of the vertical angle θ' of the cone pattern 34a and may be made to comply with the use of an appliance.

In order to convert an output angle θ of a light beam outputted from the light-guide plate 34 for the purpose of progressing the light beam in a direction perpendicular to the liquid crystal panel, the light-path converter 36 is arranged above the light-guide plate 34. The light-path converter 36 will be described below. As the light-path converter 36 may be used a forward prism sheet having a vertical angle θ' of 90° to 130° . Alternatively, as the light-path converter 36 may be prism sheets 40 and 42 having a desired between angle ϕ arranged in a backward direction as shown in Figs. 8A and 8B. In this case, it is desirable that the angle range of the between angle ϕ should be within 45° . Vertical angles of the prism sheets 40 and 42 require optical angles of more than 100° . In

this case, the light lines of the lamp and the wall surface reflection phenomenon can be considerably reduce or removed in comparison to the case of using a prism sheet having an acute angle of 60° to 70° . Otherwise, a hologram sheet may be used as the light-path converter 36. In this case, the hologram sheet converts a light beam outputted from the light-guide plate 34 in such a manner to be perpendicular to the liquid crystal panel without any dispersion. It is desirable that a space and a shape of the hologram pattern should be controlled to correspond to an output angle of a light beam progressing to the liquid crystal panel. By the above-mentioned configurations, a back light with a high light-condensing capability may be made.

Above the prism sheet 34, the diffusion sheet 38 for diffusing a light beam progressing perpendicularly to the liquid crystal panel into the entire area of the liquid crystal panel is arranged.

As described above, according to the present invention, the cone pattern is formed at the light-guide plate 34 to use only one prism sheet and only one diffusion sheet. Also, a reflection of the light-guide pattern and wall surface as well as the bright lines of the light input can be minimized. In addition, kinds of sheets can be reduced to improve the light efficiency as well as to reduce the manufacturing cost.

[Effect of the invention]

As described above, according to the present invention, a back light unit minimizes a reflection of the pattern and wall surface of a light-guide plate as well as bright lines of a light input.

In addition, the back light unit according to the present

invention has an advantage of improvement the light efficiency as well as reduction of the manufacturing cost. Although the present invention has been explained by the embodiments shown in the drawings described above, it should be understood to the ordinary skilled person in the art that the invention is not limited to the embodiments, but rather that various changes or modifications thereof are possible without departing from the spirit of the invention. Accordingly, the scope of the invention shall be determined only by the appended claims and their equivalents.

[What is claimed is:]

1. A back light unit in a liquid crystal display including a lamp generating a light beam, and a light input having a lamp housing for packaging the lamp and reflecting the light beam, said unit comprising:

a light-guide plate provided with a cone pattern to uniformly guide the light beam passing through the light input;

light-path converting means for controlling a progress direction of the light beam in such a manner that the light beam outputted from the light-guide plate is progressed in a direction perpendicular to a liquid crystal panel; and

a diffusion sheet for diffusing the light beam passing through the light-path converting means into the liquid crystal panel.

2. The back light unit according to claim 1, wherein the cone pattern is formed at at least one of the upper surface and the lower surface of the light-guide plate.

3. The back light unit according to claim 2, wherein a vertical angle of teh cone pattern has a range of 30° to 120° .

4. The back light unit according to claim 2, wherein a diameter of the cone pattern has a range of 100 to 500 μm and a height thereof has a range of 50 to 900μm.

5. The back light unit according to claim 1, wherein a space of the cone pattern is controlled to correspond to a

distribution of the light beam.

6. The back light unit according to claim 1, wherein the light-path converting means is a forward prism sheet having a vertical angle of 90° to 130° .

7. The back light unit according to claim 1, wherein the light-path converting means is a backward prism sheet having a desired between angle.

8. The back light unit according to claim 7, wherein a between angle of the backward prism is within 45° and a vertical angle thereof is above 100° .

9. The back light unit according to claim 1, wherein the light-path converting means is a hologram sheet.

10. The back light unit according to claim 9, wherein a space and a shape of the hologram pattern are controlled to correspond to an output angle of a light beam progressing into the liquid crystal panel.

ABSTRACT

[Abstracting]

A back light unit in a liquid crystal display is disclosed. In the back light unit, a light-guide plate is provided with a cone pattern to uniformly guide a light beam passing through a light input. A light-path converter controls a progress direction of the light beam in such a manner that the light beam outputted from the light-guide plate is progressed in a direction perpendicular to a liquid crystal panel. A diffusion sheet diffuses the light beam passing through the light-path converter into the liquid crystal panel.

Accordingly, a reflection of the light-guide pattern and wall surface as well as the bright lines of the light input can be minimized. In addition, the light efficiency can be improved and the manufacturing cost can be reduced.

[Representative Drawing]

Fig. 3